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POST LATCHING SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATIONS

20 This application is a continuation-in-part of application Serial No. 07/834/248, filed February 13, 1992, <sup>and not abandoned</sup> which is a continuation-in-part of application Serial No. 07/403,665, filed September 6, 1989, now U.S. Patent No. 5,022,243.

25 This application is also a continuation-in-part of application Serial No. 08/011,196, filed January 29, 1993, <sup>and not abandoned</sup> which is a continuation of application Serial No. 07/698,917, filed May 13, 1991, now U.S. Patent No. 5,197,314, which is a continuation of application  
30 Serial No. 07/557,305, filed July 23, 1990, now U.S. Patent No. 5,050,413, which is a continuation of application Serial No. 07/358,888, filed May 30, 1989, now U.S. Patent No. 5,027,630, which is a continuation-in-part of application Serial No. 07/327,250, filed  
35 March 22, 1989, now U.S. Patent. No. 4,900,182.

### BACKGROUND OF THE INVENTION

This invention relates generally to the field of latching devices and, in its most preferred  
5      embodiments, to the field of key operated door latching devices.

A latching device holds lids, doors, and other closure pieces in a closed position on related boxes, cabinets, vending machines, doorways and other framed  
10      structures. When desired to maintain the structure secure, the latch mechanism is provided with a locking device, such as a keyed lock. There are great numbers of latching and locking devices available on the market, yet not all these devices are capable of  
15      meeting the needs of high security areas and/or withstanding the demands of high impact and abusive areas.

By way of example, but not limitation, one high security and abusive area requiring specially designed  
20      latching and locking devices is that of vending machines. Hordes of vandals have taken a large toll on the vending machine industry, pilfering millions of dollars yearly from destroyed or illegally accessed money boxes. Vandals use numerous methods, including  
25      the use of professional tools, with varying degrees of brutality, to open the door and access the money. Needless to say, the industry is desperately seeking new latching and locking devices which will thwart the efforts of the vandals and otherwise provide tight,  
30      secure and dependable latching and locking.

### SUMMARY OF THE INVENTION

Briefly described, the first preferred embodiment of the present invention includes a notched post  
35      latching system. The latching system of the first

preferred embodiment of the present invention comprises a notched post assembly, a post latching assembly, and a handle assembly. In preferred embodiments, the invented latching system also includes a lock assembly associated with the handle assembly. The post assembly and post latching assembly are, in a preferred application, cooperatively mounted each to one of a closure piece (hereinafter generally referred to as the "door") and a related framed structure (hereinafter generally referred to as the "door frame").

The notched post assembly is comprised, in at least one of its embodiments, of an elongated post formed at one end with at least two opposing, axially extending rows of notches or teeth. The post is mounted at its other end to a mounting assembly for rotation within the mounting assembly about the axis of the post. The post latching assembly comprises a channel for accepting the notched end of the post and comprises movable latch elements which cooperate with the notches of the post to effect the primary latching function of the system. The cooperation of the post notches and the latch elements allows for entry of the notched end of the post into the latching assembly channel, but resists removal of the post from the channel. Removal ("unlatching") of the post from the channel is accomplished by rotating the post to disengage the notches and the latch elements, thus allowing for removal of the post from the latching assembly.

Rotation of the post to effect unlatching is accomplished by action of the handle assembly. In its basic form, the preferred embodiment of the handle assembly includes a handle of some definition engaging, for example, the mounted end of the post. In the first preferred embodiment, the lock assembly performs the

function of the handle as well as performs the primary locking function. The primary locking function is that function of preventing rotation, and thus preventing unlatching, of the post without proper operation of a key or appropriate combination or code. The lock assembly of the preferred embodiment is of a type typically known in the art.

In accordance with at least one embodiment of the first preferred embodiment, the mounting assembly (to which the post is mounted), is rigidly attached to a door, with the post assembly rotatably supported within the mounting assembly, and the post latching assembly is rigidly attached to the door frame. Alignment of the post assembly and the post latching assembly is such that, as the door is closed, the post engages and protrudes into the channel of the latching assembly. To effect the latching function of the present invention, the rows of notches of the post are, upon protrusion of the post into the latching assembly channel, aligned with the latch elements of the latching assembly. In the embodiments incorporating a lock assembly, the interface linkage between the lock assembly and the post functions such that the latching function of the post and post latching assembly can not be released except through operation of the key or combination of the lock assembly.

Whereas certain embodiments of the first embodiment of the present invention are depicted and discussed herein, the latching system of the first preferred embodiment of the present invention is also disclosed in and is understood to comprise all of the various embodiments, inventions, and improvements disclosed in U.S. Patent 5,022,243, which is expressly incorporated herein by this reference, in its entirety.

Briefly described, the second preferred embodiment

of the present invention includes a ball and collar door latch. The door latch of the second preferred embodiment of the present invention comprises a bar and collar gripping and release mechanism cooperatively mounted to the door and door frame of a vending machine or money box cabinet to provide the initial latching function in the form of a frictional gripping of the bar by the collar, and also comprises a lock assembly associated with the bar and collar mechanism to provide a primary locking function and to effect release of the latching function. In accordance with the second preferred embodiment of the present invention, the lock assembly is of a type typically known in the art and is connected by interface linkage to the bar so as to effect release of the latching function of the bar and collar mechanism.

The bar of the bar and collar mechanism is rigidly attached to one of the door elements (either the door or the door frame) and the collar portion is rigidly attached to the other of the door elements. Alignment of the bar and collar is such that, as the door is closed, the bar engages and protrudes into the axial passage of the collar's inner shell. To effect the latching function of the present invention (the ball-on-arc latching function) the arcuate surface of the bar is, upon protrusion of the bar into the collar passage, aligned with the balls of the collar. The interface linkage between the lock assembly and the bar and collar mechanism functions such that the latching function of the bar and collar can not be released except through operation of the lock assembly. In the preferred embodiments of the second preferred embodiment of the present invention, the lock assembly, through interaction of the interface linkage, releases the latching function of the bar and collar by one or

both of the "axial-pull" release method or the "angular-twist" release method. Upon release of the latching function, the door of the vending machine (or money box cabinet) can be opened, since the bar will pull free of the collar.

The components and functions of the bar and collar mechanism are understood by reference to U.S. Patent No. 4,900,182 which is expressly incorporated herein by this reference, in its entirety. For a better understanding of the frictional-grip, latching function (the ball-on-arc gripping function) and the related "axial-pull" releasing method, please refer to U.S. Patent No. 4,900,182. Whereas certain embodiments of the second embodiment of the present invention are depicted and discussed herein, the latching system of the second preferred embodiment of the present invention is also disclosed in and is understood to comprise all of the various embodiments, inventions, and improvements disclosed in U.S. Patent No. 5,197,314, which is expressly incorporated herein by this reference, in its entirety.

It is, therefore, an object of the present invention is to provide a latching system to assist in deterring vandals.

Another object of the present invention to provide a door latch which greatly hinders the efforts of vandals to break through the locked door latch.

Still another object of the present invention is to provide a vending apparatus, cabinet or the like which comprises a unique door latch to assist in deterring vandals.

Still another object of the present invention is to provide a latching system which is durable and capable of holding a door and door frame in a latched manner in the face of abusive treatment.

Still another object of the present invention is to provide a latching system which effects strong latching between latch components yet is quickly and easily unlatched.

5 Still another object of the present invention is to provide a door latch which effects a gripping action between latch components, whereby the gripping force increases as the door is pulled or pried without proper operation of the key or combination.

10 Still another object of the present invention is to provide an improved latching system which can be retrofit to existing framework.

Other objects, features and advantages of the present invention will become apparent upon reading and understanding the present specification and the patents  
15 incorporated herein by reference, when taken in conjunction with the appended drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is a side view of the improved latching system in accordance with the first preferred embodiment of the present invention, with parts cut away for clarity and with latching components unconnected and unsupported by closure pieces.

25 Fig. 2A is an isolated, top view of a post assembly of the latching system of Fig. 1.

Fig. 2B is an end view of the isolated post assembly of Fig. 2A, seen from the right end of Fig. 2A.

30 Fig. 2C is an isolated, enlarged view of that top view of the portion of the post assembly as indicated by the circle of Fig. 2A.

Fig. 2D is a view of the isolated portion of the post assembly seen in Fig. 2C, seen from what would be  
35 the side view of Fig. 1 and the top of Fig. 2C.

Fig. 2E is an end view of the isolated post assembly of Fig. 2C, seen from the left end of Fig. 2C.

Fig. 3A is an isolated, cutaway side view of a post housing assembly of the latching system of Fig. 1.

5 Fig. 3B is an end view of the isolated post housing assembly of Fig. 3A, seen from the right end of Fig. 3A.

10 Fig. 4A is an isolated, side view of a latch housing of the latching system of Fig. 1, with certain component portions removed.

Fig. 4B is a view of the element of Fig. 4A, taken along line 4B-4B of Fig. 4A.

Fig. 4C is a view of the element of Fig. 4A, taken along line 4C-4C of Fig. 4A.

15 Fig. 5A is an isolated end view of a latch element of the post latching assembly of Fig. 1.

Fig. 5B is a side view of the latch element of Fig. 5A.

20 Fig. 5C is an isolated view of the post latching assembly of the latching system of Fig. 1, taken along line 5C-5C of Fig. 1.

25 Fig. 6A is an isolated, enlarged view of that top view of the portion of the post assembly as indicated by the circle of Fig. 2A, but showing an alternate embodiment to that of Fig. 2C.

Fig. 6B is a view of the isolated portion of the post assembly seen in Fig. 6A, seen from what would be the side view of Fig. 1 and the top of Fig. 6A.

30 Fig. 6C is a view of the isolated post assembly of Fig. 6A, as seen along line 6C-6C of Fig. 6A.

Fig. 7 is an isolated side view, with portions cut away, of a Door Latch, and related door components, in accordance with the second preferred embodiment of the present invention.

35 Fig. 8 is an isolated view of the post of Fig. 7,



as if taken along line 8-8 of Fig. 7, and depicting one embodiment thereof.

Fig. 9 is an isolated view of the post of Fig. 7, as if taken along line 9-9 of Fig. 7, and depicting an  
5 alternate embodiment to that of Fig. 8.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring now in greater detail to the drawings in which like numerals represent like components  
10 throughout the several views, a first preferred embodiment of the latching system 10 of the present invention is seen in Fig. 1 as comprising a post assembly 11, a post latching assembly 12, and a handle assembly 60. A mounting assembly 44 is, in the  
15 disclosed embodiment, associated with the post assembly 11 and the handle assembly 60. The post assembly 11 includes, generally, an elongated post 14. The post 14 of the preferred embodiment (with reference to Figs. 1 and 2A-2E) is seen as including a mounting portion 13,  
20 a latching portion 15, a post extension portion 16 and a coupling portion 19. The mounting portion 13 is that portion by which the post 14 is mounted to the mounting assembly 44 (see Fig. 1). The mounting portion 13 is defined between two annular grooves 35, 36. The  
25 latching portion 15 is defined at the end of the post 14 opposite the mounting portion 13, and is that portion by which the post is "gripped" by the post latching assembly 12 to effect the primary latching function of the latching system 10. The latching  
30 portion 15 is formed as a "multi-surfaced" segment; that is, the surface of the latching portion alternates, about opposite quadrants of this post 14, between notched surfaces 17 and smooth surfaces 18. One embodiment of the latching portion 15 is seen in  
35 greatest detail in Figs. 2C, 2D, 2E, and includes two

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notched surfaces 17 and two smooth surfaces 18. Each notched surface 17 of the illustrated embodiment includes a single row of arcuate teeth 38, which teeth each are formed with a rearwardly tapered leading surface 39 and a radially extending trailing surface 40. The row of teeth 38 of each notched surface 17 extends lengthwise along the latching portion 15 of the post 14. Each tooth 38 extends crosswise across the respective notched surface 17. The post 14 length is varied, depending on the application, by the length of the extension portion 16. The coupling portion 19 of the preferred embodiment is seen in Figs. 2A and 2B as including a channel 42 formed along the diameter of the post 14.

The mounting assembly 44, seen in a first, preferred embodiment in Figs. 1, 3A and 3B, is comprised mainly of a support housing 45 and bearing assembly 52. The support housing 45 is generally cylindrical and is formed with an axial passage 46 of three chambers: the narrower, post support chamber 47 of first diameter; the bearing chamber 48 of second diameter; and the coupling chamber 49 of third diameter. A cylindrical bearing assembly 52 is press-fitted into the bearing chamber 48. The support housing 45 also includes an elongated rib 53 protruding from the housing cylinder. As is noted from Fig. 1, the post 14 is mounted at its mounting portion 13 within the support housing 45, rotatably supported by the bearings 52. An external locking ring 55 occupies the outer annular groove 35 of the post 14 and a spring bearing disc 56 occupies the inner annular groove 36. In the preferred embodiments, the external locking ring 55 functions, at least, to protect the post 14 from being pushed to far into the housing 45; and the spring bearing disc 56 functions, at least, to prevent the

post from pulling out of the housing. Furthermore, the spring action of the spring bearing disc 56, preferably, functions to provide a degree of flexibility when mounting in various die cast lock assemblies.

5 The handle assembly 60 is mounted within the coupling chamber 49 of the mounting housing 44. (See Fig. 1.) The handle assembly 60 of this first, preferred embodiment of Fig. 1 includes a coupling  
10 shaft 61 which interfaces with the coupling channel 42 of the post coupling portion 19; whereby, as the coupling shaft rotates, so rotates the post 14. The handle assembly 60 also includes a mechanism, such as a grip handle or lock cylinder, for effecting rotation of  
15 the coupling shaft 61. In the embodiment of Fig. 1, the handle assembly 60 embodies a lock assembly 59 for providing selective control over rotation of the coupling shaft 61.

The latching assembly 12 (refer to Figs. 1 and  
20 4A-4C) includes a latch housing 20 formed with an axial passage 21 for accepting the latching portion 15 of the post therein. The post entry end 23 of the axial passage 21 is flared as with a chamfer. The latch housing 20 of the preferred embodiment is also formed  
25 with two opposing radial slots 25, 26 which slots are cut deep enough into the housing 20 to breach the axial passage 21. As seen in Fig. 1, positioned within each of the radial slots 25, 26 is a latch element 27, 28. The latch elements 27, 28 (refer to Figs. 5A and 5B)  
30 are formed as semicircular plates with their straight edges 30 inserted into the respective radial slot 25, 26 such that the straight edges protrude into the axial passage 21 of the housing 20. In the preferred embodiment, the straight edges 30 of the latch elements  
35 27, 28 are tapered (in a semicircular region of taper

31) as seen in Figs. 5A and 5B; and the latch elements are oriented within the slots 25, 26 with the taper 31 oriented relative to the post entry end 23 of the axial passage 21 as shown within Fig. 1. The latch elements 27, 28 are retained within the radial slots 25, 26 by an elastic member 32. In the preferred embodiment, the elastic member 32 is comprised of two O-rings 32a, 32b. The O-rings 32a, 32b, in their normally compressed mode, bias the latch elements 27, 28 to their most radially inward position with the straight edges 30 pressed against the inner surfaces of the radial slots 25, 26 (refer to Fig 5C). The O-rings allow the latch elements 27, 28 to move temporarily, radially outward in response to an outward force at the straight edges 30; and the o-rings return the latch elements to their inward position when such force is removed. As seen in Fig. 1, a cylindrical, protective sleeve 33 removably covers the radial slots 25, 26.

To operate the primary latching function of the latching system 10, the post 14 is rotated to align the rows of teeth 38 of the post latching portion 15 with the latch elements 27, 28 of the post latching assembly 12. To release the primary latching function, the post 14 is rotated to move the rows of teeth 38 out of alignment with the latch elements 27, 28.

In the preferred embodiment, the post assembly 11 is mounted, as by the mounting assembly 44, to, for example, a door 78; and the post latching assembly 12 is mounted, as by the latch housing 20 to, for example, the related door frame 75. The post assembly 11 and latching assembly 12 are so aligned that, when the door 78 is closed, the post latching portion 15 engages and protrudes into the axial passage 21 of the latch housing 20. The lock assembly 59 is inserted into the coupling chamber 49 of the support housing 45 with the

coupling shaft 61 interfacing the coupling portion 19 of the post 14. The lock assembly 59 is installed such that, when locked, the rows of teeth 38 on the post 14 are aligned with the latch elements 27, 28, as represented in Fig. 1. With the lock assembly 59 in the locked position, when the door 78 is closed, the rows of teeth 38 of the post 14 are, upon protrusion of the post latching portion 15 into the axial passage 21, engaged by the latch elements 27, 28. As the tapered leading surfaces 39 of the teeth 38 contact the tapered surfaces 31 of the latch elements 27, 28, the resultant force overcomes the elastic bias of the O-rings 32 and the latch elements move to allow entry of the post 14 into the latching assembly 12 until the door is completely closed.

If it is attempted to remove the post latching portion 15 from the axial passage 21, the radially extending trailing surfaces 40 of the teeth 38 will strike flatly against the radially extending, non-tapered surfaces 29 of the latching element straight edges 30. Thus the post 14 will not be removable. This is the primary latching function. The door 78 is now latched to the frame 75 and can only be opened by operating the lock assembly 59. When the lock assembly is operated, the coupling shaft 61 turns the post 14 to move the rows of teeth 38 out of alignment with the latch elements 27, 28 and move the smooth surfaces 18 into alignment with the latch elements. The door can now be opened as the post will move freely out of the latching assembly 12. Before the door 78 is again closed, the lock assembly 59 is returned to the locked configuration, where the rows of teeth 38 will again be aligned with the latch elements 27, 28.

Whereas, the preferred embodiment of the latching

portion 15 of the post 14 is depicted in Figs. 2C and 2E as including smooth surfaces 18 which are each curved surfaces (i.e. convex arcs in their end profile as seen especially in Fig. 2E), other alternate  
5       embodiments of the smooth surface 18 are contemplated within the broad scope of the invention. One such alternate embodiment is depicted in Figs. 6A, 6B and 6C. In this alternate embodiment of Fig. 6, the smooth  
10       surfaces 18" are each flat surfaces (i.e. straight lines in their end profile formed from a plurality of radii from a central axis of the post 14 as seen in Fig. 6C).

A door latch 111 of the second preferred embodiment of the present invention is seen in Fig. 7.  
15       The embodiment of Fig. 7 is uniquely constructed to utilize a lock assembly 188 to activate an angular-twist release function of a post and collar mechanism 110 by angular rotation of a post 114. Please refer to U.S. Patent No. 4,900,182 for an  
20       explanation of the angular-twist release function, and Patent No. 5,197,314 for additional information regarding post and collar 110 door latches 111. In this embodiment, a collar portion 112 is mounted to the door frame 75 and the post 114 is mounted to the door  
25       78. An outer sleeve 130 of the collar portion 112 is seen with its back end 132 formed into a mounting plate 132 by which the sleeve, and thus the collar, is mounted to the door frame 75. This is by way of example only, and side mounting or mounting from the  
30       front end 134, as well as other appropriate mounting is acceptable. The outer sleeve 130 is provided with a flange 131 at its front end 134. It is seen that the collar portion 112 is oriented such that the back end 125 of inner shell 120 is facing the door 78 so as to  
35       accept the post 114 in the proper latching operation.

The collar portion 112 further includes a biasing spring 148 and a tension ring 135. The post 114 of the embodiment of Fig. 7 is mounted to the door 78 within a housing 150, together with the lock assembly 188. The lock assembly 188 is mounted by one or more set screws or pins 194 in the manner described with respect to Fig. 1 of Patent No. 5,197,314. A latching portion 115 of the post 114 protrudes from the housing 150 with a mounting portion 113 of the post supported by self-aligning bearings 151 within the housing. A shaft 198 is attached to the lock assembly 188, and a collar 101, which is rigidly attached to (for example, formed as part of) the post 14. The pin 199 connects the shaft 198 to the post collar 101 to effect rotation of the post 114 upon operation of the lock assembly 188. The latching portion 115 of the post 114 is seen in this embodiment as being multi-surfaced, similar to those embodiments described with respect to Fig. 1 of Patent No. 5,197,314. Thus it is seen that the latching function of the embodiment of Fig. 7 is accomplished by arranging the locking assembly 188 so that first surfaces 117 of the post are aligned with balls 152 of the collar portion 112 when the lock assembly is in the lock position. When the door 78 is closed and the latch in effect, the latch is released by operating the lock assembly 188 to thus turn the post 114, until inner second surfaces 118 (of reduced radius "r") are aligned with the balls 152 of the collar portion 112. Thus, the angular-twist latch release is effected.

The post 114 is seen in Fig. 7 as comprising, generally, two portions: the mounting portion 113 and the latch portion 115 by which the post is "gripped" by the collar 112 to effect the primary latching function. The latch portion 115 of this embodiment is seen as

being "multi-surfaced". The term "multi-surfaced" is used to indicate that the surface of the latch portion 115 of the post 114 alternates, about the circumference of the post, from the first surface 117, defined at an outer radius ("R") from the post axis 154, to a second surface 118, defined at an inner radius ("r") from the post axis 54. With reference to Figs. 8 and 9, two alternate configurations of the multi-surfaced latch portion 115 of the post are studied. Fig. 8 depicts an isolated end view (as if taken along line 8-8 of Fig. 7) of the multi-surfaced latch portion 115 of the embodiment disclosed in U.S. Patent No. 4,900,182, and acceptable as one embodiment of the present invention, wherein the alternating surfaces are arcuate surfaces 117 and flat surfaces 118. The latch portion 115 of Fig. 9 depicts an isolated end view (as if taken along line 9-9 of Fig. 7) of an alternate embodiment of post 114, wherein the alternating surfaces are convex (arcuate) surfaces 117 and concave surfaces 118, defining, for example, a series of elongated ridges 117 and troughs 118. In each of the embodiments of Figs. 8 and 9, and in other possible embodiments, the first surface 117 defines an outer radius "R" of sufficient distance to force frictional engagement of the balls 152 against the tension ring 135 during the ball-on-arc gripping function; and the second surface 118 defines a lessened radius so as to avoid frictional engagement between the balls 152 (when aligned with the point of inner radius "r") and the tension ring 135.

It is understood that the relative dimensions and relationships shown on the drawings are given as the preferred relative dimensions and relationships; but the scope of the invention is not to be limited thereby.

Whereas the present invention has been described



in detail herein with specific reference to particular  
embodiments thereof, it will be understood that  
variations and modifications can be effected within the  
spirit and scope of the invention as described  
5 hereinbefore and as defined in the appended claims.

I claim: